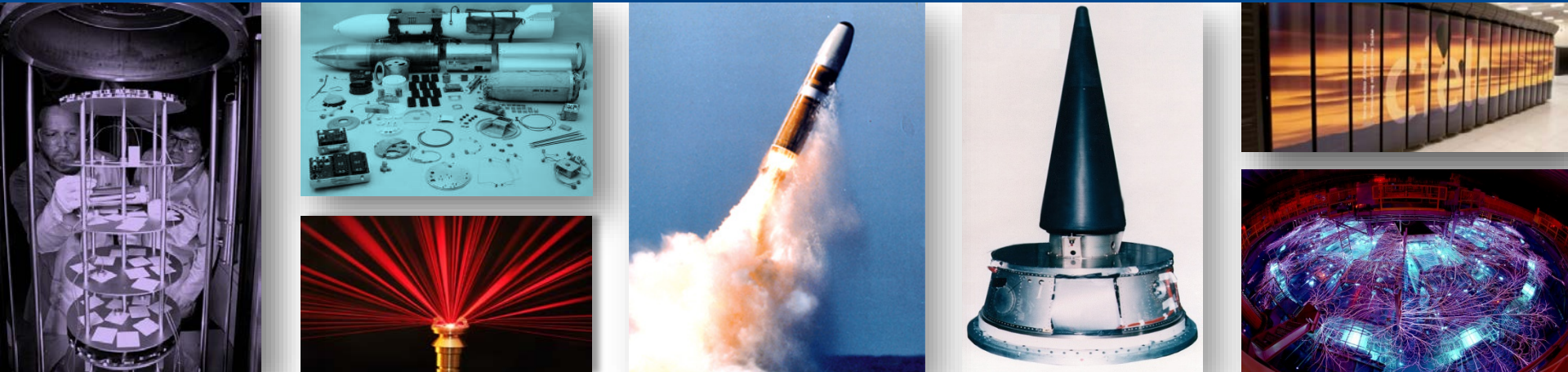




# Plutonium Pit Production Engineering Assessment (EA) Results

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# Introduction

## In accordance with the Nuclear Weapons Council Strategic Plan, NNSA will produce 80 WR ppy in 2030

- The 2018 NPR emphasizes the need for “*an effective, responsive, and resilient nuclear weapons infrastructure*” that can “*adapt flexibly to shifting requirements*”
- NNSA will produce an enduring 30 pits per year (ppy) in 2026 in Plutonium Facility (PF)-4 at Los Alamos National Laboratory (LANL) under all alternatives
- The Engineering Assessment (EA) evaluated alternatives to provide an additional 50 ppy capability
- EA schedule estimates are **conservative**; NNSA will aggressively pursue risk reduction opportunities to meet this requirement
- The Pu Pit Production EA is a follow-on activity to the Analysis of Alternatives (AoA) to support DOE and NNSA decision-makers



# Plutonium Infrastructure Past & Present

- Throughout the Cold War, multiple facilities and sites supported defense plutonium missions
  - Rocky Flats (CO), Pinellas (FL), Savannah River Site (SC), Hanford (WA), Lawrence Livermore National Laboratory (LLNL) (CA), and LANL (NM)
- Currently, the sole U.S. pit production capability is located in LANL's PF-4, which is 40 years old and will be over 50 years old in 2030
  - NNSA continues to provide resources to maintain PF-4 in an operational condition
  - Replacement and/or life extension will be required in the future
- The increased operating tempo will be a challenge and PF-4 is a single point failure for this and other defense plutonium missions
- At the Savannah River Site, a former plutonium production site, there is a new security category 1/hazard category 2 structure that no longer has a mission need



# Analysis of Alternatives Results

- NNSA completed an AoA for plutonium pit production in October 2017 as required by DOE Project Management requirements (DOE Order 413.3B)
- The AoA assessed alternatives capable of producing 50 ppy (in combination with 30 ppy in PF-4) and 80 ppy (stand-alone) to meet the sustained production capacity of no fewer than 80 ppy in 2030
- 41 options were evaluated and 5 options were selected for detailed analysis
- Of those 5 options, 2 preferred alternatives were identified
  1. Refurbishing and repurposing facilities at the Savannah River Site
  2. Constructing additional facilities at LANL



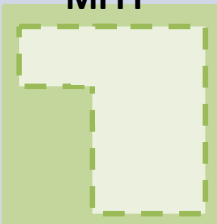



# Engineering Assessment (EA) Scope

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- The EA analyzed 50 WR ppy capacity options to complement an enduring 30 WR ppy mission beginning in 2026 at LANL
  
- EA was completed by Parsons with plutonium expertise provided by a team of subject matter experts
  
- It provides analysis related to
  - Cost
  - Schedule
  - Risk
  - Feasibility
  
- Four alternatives were evaluated
  - 1 alternative at SRS
  - 3 alternatives at LANL

# Alternatives Assessed

All alternatives assume an enduring 30 WR ppy in PF-4 at LANL in 2026

| Alternative  | Additional PF-4 Scope for 50 PPY  | Process Scope for New Space   | New Process Space Size and Layout   |
|--|---|---|---|
| <p><b>1-Modify MFFF at SRS with Production Modules</b><br/><i>Install pit production equipment into the existing MFFF at the Savannah River Site to produce 50 ppy</i></p>   | <p>None</p>   | <p>Disassembly/Metal Prep<br/>Foundry<br/>Machining<br/>Assembly<br/>Aqueous<br/>Analytical Chemistry<br/>Material Characterization</p> | <p>65,721 ft<sup>2</sup></p> <p>MFFF</p>                                     |
| <p><b>2a –Construct a Production Module at LANL – Production Facility Outside PF-4</b><br/><i>Construct a new production facility with 25,873 ft<sup>2</sup> of process space at LANL to produce 50 ppy</i></p>  | <p>Aqueous</p>  | <p>Disassembly/Metal Prep<br/>Foundry<br/>Machining<br/>Assembly</p>  | <p>25,873 ft<sup>2</sup></p> <p>50 ppy Production Facility Module</p>        |
| <p><b>2b – Construct a Production Module at LANL – Production Capacity Split with PF-4</b><br/><i>Construct a new production facility with 18,488 ft<sup>2</sup> of process space and install additional equipment in PF-4 to produce 50 ppy with a split flowsheet between the facilities</i></p>                       | <p>Disassembly/Metal Prep<br/>Aqueous</p>   | <p>Foundry<br/>Machining<br/>Assembly</p>   | <p>18,488 ft<sup>2</sup></p> <p>Production Module with Split Flowsheet</p>  |
| <p><b>2c – Use PF-4 as a Bridge Until Construction of Production Modules at LANL is Complete</b><br/><i>Install additional equipment in PF-4 to produce 80 ppy using 2 shifts while constructing at least 3 new production facilities with 23,370 ft<sup>2</sup> of total process space that will produce 50 ppy</i></p> | <p>Bridge (2 Production Shifts):<br/>Augment Production Capabilities in PF-4 (15 additional pieces of equipment)</p> <p>With Modules:<br/>Aqueous</p> | <p>Bridge: N/A</p> <p>Modules:<br/>Disassembly/Metal Prep<br/>Foundry<br/>Machining<br/>Assembly</p>                                    | <p>23,370 ft<sup>2</sup></p> <p>Multiple Production Modules</p>            |



# Cost and Schedule



- **The most conservative schedule estimates to achieve 80 ppy extend beyond 2030 for all alternatives, but opportunities exist to manage schedule risk**
- Cost and schedule ranges are for comparison purposes only and are based on Class 5 estimates (-20% to +100%) consistent with this phase of project definition
  - These are NOT baselined estimates, which will be set at Critical Decision 2 in 2022
- Schedule and risk distinguish the alternatives from each other more than does cost
- Schedule ranges reflect high-confidence estimates for construction completion





# Cost, Risk, and Schedule Comparison

These are not baselined costs or schedules and multiple opportunities exist to expedite the schedule with appropriate leadership direction

| Alternative   | Estimated Construction Range High End | Residual Risks  | Estimated Construction Completion (CD-4) Range   |
|---|---------------------------------------|---|--|
| 1 – Modify MFFF at SRS with Production Modules                      | \$4.6 B                               |  10 Opportunities<br> 3 Moderate Threats   | Jul. 2026 – Jan. 2030  |
| 2a – Construct a Module at LANL – Production Facility Outside PF-4  | \$5.2 B                               |  1 Opportunity<br> 11 Moderate Threats   | Apr. 2028 – Oct. 2031  |
| 2b – Construct a Module at LANL – Production Capacity Split w/ PF-4 | \$4.4 B                               |  1 Opportunity<br> 11 Moderate Threats<br> 1 High Threat     | Mar. 2027 – Sep. 2030  |
| 2c - Use PF-4 as a Bridge Until Construction of Modules at LANL     | \$5.8 B                               |  1 Opportunity<br> 19 Moderate Threats<br> 3 High Threats | PF-4 Modifications –<br>Nov. 2025 – May 2029<br><br>Modules – Jan. 2032 -<br>Jul. 2035 |





# Schedule Opportunities

- NNSA can shorten the schedule several years through leadership direction
- Several opportunities exist to shorten the **construction** schedule, including:
  - Working with Congress to secure a robust optimal funding profile
  - Using 2 shifts for construction and commissioning activities (the EA assumes 1 shift)
  - Tailoring processes by shortening review cycles and performing activities in parallel instead of in sequence
  - Managing scope to accelerate schedule
- Hot commissioning, qualification and ramp up to 50 WR ppy are assumed to take 5-10 years, but several opportunities exist to meet the 2030 date, including:
  - Applying lessons learned from reaching 30 ppy to reduce time to produce WR pits
  - Establishing an aggressive operational release plan
  - Leveraging LANL, regardless of option selected, to support workforce development
- Regardless of the site selected for the 50 ppy mission, NNSA could maximize pit production in PF-4 to the extent practicable while simultaneously pursuing construction at either site
  - This would reduce schedule risk but also introduce additional operational risk from double shift work

NNSA remains committed to producing 80 ppy in 2030 and will aggressively pursue risk reduction opportunities to meet this requirement



## Lifecycle Costs (LCC)

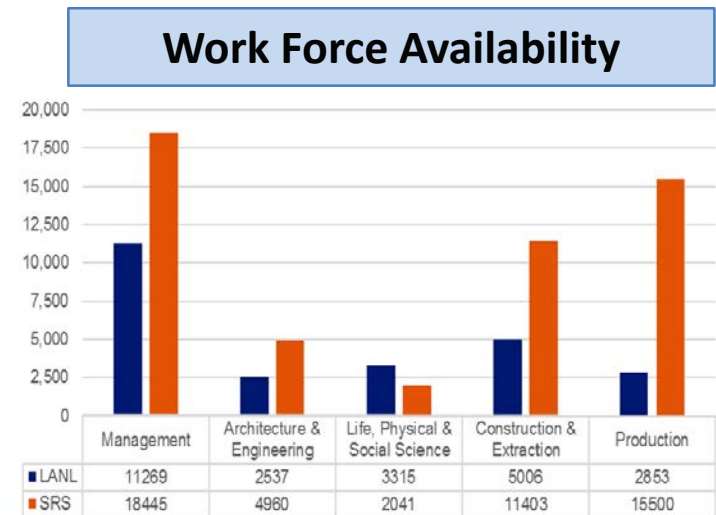
| Alternative 1 | Alternative 2a | Alternative 2b | Alternative 2c |
|---------------|----------------|----------------|----------------|
| \$27.8B       | \$18.8B        | \$14.3B        | \$14.8B        |

- Pit production activities at two sites would result in higher LCCs
- LCCs do not include the future cost of PF-4 replacement or life extension
- LCCs costs do not include offset to Alternative 1 (MFFF) by reducing overall nuclear complex LCCs (e.g., consolidating K-Area Material Storage Facility activities in MFFF and enabling DOE/NNSA to exit an old facility)
- Path forward should not be decided solely on lowest cost, which could constrain pit production to a single facility at a single site
- The alternative with the lowest LCC would not meet the Administration's stated policy for "***an effective, responsive, and resilient nuclear weapons infrastructure***" that can "***adapt flexibly to shifting requirements***"



# Workforce Analysis

- LMI studied the demand for pit production personnel
  - Manufacturing an additional 50 ppy at LANL requires between 350-500 additional production staff
  - Manufacturing 50 ppy at SRS requires 722 production staff
- LMI translated LANL job descriptions to Bureau of Labor and Statistics Standard Occupational Classifications (SOC) to use census data to evaluate supply in a 50-mile radius
- Both locations could support increased staffing; however, there are more workers available in the SRS locality in 4 of the 5 job classifications studied
- Cost of living and average age of the workforce are both lower near SRS when compared to LANL



Source: U.S. Census 2016 American Community Survey.



## Recommended Alternative

- The best strategy for achieving 80 WR ppy in 2030, is to:
  - Repurpose MFFF to produce 50 WR pits
  - Maximize pit production in PF-4 to extent practicable
- This approach:
  - Capitalizes on enduring 30 WR ppy capability in PF-4, which can increase with 2 shifts
  - Retains LANL as the Plutonium Center of Excellence
  - Embraces the Administration’s policy for “an effective, responsive, and resilient nuclear weapons infrastructure” that can “adapt flexibly to shifting requirements”
  - Executes the lowest risk alternative with shortest construction schedule; while utilizing PF-4 to build ahead as much as possible
  - Provides the Nation with an appropriately tailored robust, redundant, and resilient pit production capability



# BACK UP SLIDES



# EA Process

Oct. 2017

- AoA concludes
- NA-1 Directs the Office of Defense Programs (NA-10) and the Office of Acquisition and Project Management (NA-APM) to conduct an EA
- NA-10 creates a group of Subject Matters Experts (SME) from the NNSA Production Office (NPO), LANL, LLNL and SRS to provide plutonium expertise to Parsons

Nov. 2017 –  
Jan. 2018

- NNSA briefs Congressional staff, NWC and others on the AoA and the decision to perform an EA
- EA team conducts five site visits and working sessions at LANL, SRS and DOE HQ
- EA team develops equipment lists, conceptual layouts and qualitative risk matrices for each alternative in coordination with SMEs
- LANL provides input for its proposed modular concept, Alternative 2c

Feb. 2018

- Initial draft of report released to SMEs for review and comment
- Working session is held at Parsons HQ in DC to resolve comments from SMEs and Parsons senior management

Mar. –Apr.  
2018

- Factual accuracy review with Federal and contractor representatives from LANL, LLNL, and SRS
- DoD “Reading Room” – Draft EA report provided to reviewers from OSD/NM, OSD/P, Joint Staff, STRATCOM, and CAPE
- EA results briefed to ASD(NCB), NWC Standing & Safety Committee, and NWC Executive Session